REMARKS

Claims 1-6 are presently pending in the application.

Claim 1 has been amended to recite that the superficial gas velocity in the intermediate cylindrical section is about 0.9 to 7.2 m/s. This amendment is supported in the specification at least at page 8, lines 16 to 22, which teaches that the gas velocity in the intermediate cylindrical section is about 3 to 6 times faster than in the dense fluidizing layer (i.e., 0.3 to 1.2 m/s). No new matter has been added by this amendment, and entry is respectfully requested.

The Examiner has again rejected claims 1-6 under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 3,409,542 of Molstedt ("Molstedt"). Briefly, the Examiner again argues that Molstedt discloses a process of discharging and transferring upwardly fluidized particles from a dense fluidized layer forming section to an upper section having a diameter that is smaller than the dense fluidized layer forming section, wherein an intermediate cylindrical section (cone) is provided between the dense fluidized forming section and the upper section. Molstedt allegedly teaches that the intermediate section has truncated cone ends connected to the dense fluidized layer forming section and said upper section, respectively, the former having an elevation angle of 60°.

The Examiner again argues that it would have been obvious to one having ordinary skill in the art at the time of the invention to have modified the process of Molstedt by using an intermediate section with an elevation angle of 85° or greater because the gas velocity would be the same or similar when using either a shorter-pipe intermediate section with an elevation angle of less than 85° or a longer pipe intermediate section with an elevation angle of 85° or greater.

In response to Applicants' previous argument that the claimed intermediate section would result in a small average pressure change in the riser, which would enhance the circulating of particles in the process without clogging, the Examiner takes the position that it is within the skill in the art to change the elevation angle of the intermediate section of Molstedt to result in a small average pressure drop to circulate particles in the process smoothly.

Finally, the Examiner contends that Applicants' previously submitted 132 Declaration is not persuasive since it only compares an intermediate section having an angle of 90° with the intermediate section of Molstedt, but does not compare sections having angles of 85°, 100°, or 170°. Therefore, the Examiner concludes that the unexpected results are not commensurate with

the scope of the claims. Further, the Examiner notes that the showing of unexpected results in terms of average pressure change and particles circulated smoothly when using an intermediate section having an angle of 90° is not persuasive because it would be expected that an average pressure change would be small and particles would circulate more smoothly when using an intermediate section with a wider angle.

Applicants respectfully traverse this rejection and the arguments in support thereof as follows for the reasons set forth previously on the record, which Applicants rely upon in full, and for the additional reasons which follow, and respectfully request reconsideration and withdrawal of the rejections.

As previously explained and described in the Background section of the present application (see page 7, lines 4-17), in the surface of the dense fluidizing layer in fluid catalytic cracking (FCC) devices, clusters of particles jump from the surface when bubbles rising through the layer rupture. The clusters then break up, and part of the cluster descends and part rises. In a relatively short freeboard (upper space), as in traditional devices, the clusters cannot break up completely, even if the upper portion of the dense fluidizing layer forming section is formed into a truncated cone. Therefore, clusters can pass through the upper portion and reach the high velocity transferring section. As a result, the amount of transferred particles varies and pressure loss occurs.

In contrast, according to the present invention, an apparatus used in a process of discharging and transferring fluidized particles contains an intermediate section having an elevation angle of 85° or greater which is provided between the dense fluidizing layer forming section (the reactor) and the high-velocity transferring section (the riser). In a structure with such an intermediate cylindrical section, the rising rate of a mixture of fluidizing gas and particles (catalyst) is relatively less than that through a tapered section. Accordingly, the residence time of the mixture in the section becomes longer and the clusters of the particles (catalysts) which have been generated in the reactor can fully break up while rising through the section, so that the particles are uniformly dispersed in and rise uniformly with the fluidizing gas. Therefore, use of the apparatus in the claimed method decreases variations in the quantities of particles to be discharged from the reactor and transferred to the riser, as well as changes of

pressure in the riser, making it possible to smoothly and stably transfer the particles through the system without clogging the cyclone separator or the particle down-flow circulating line.

In the presently claimed invention, an intermediate section is formed into a substantially cylindrical shape and the superficial gas velocity is about 0.9 to 7.2 m/s, whereby the cluster of particles from the reactor fully breaks up while rising slowly therethrough. The particles can thus reach the riser in a uniformly dispersed state, as described at page 10, line 19 through page 11, line 4 of the specification. That is, due to the substantially cylindrical shape of the intermediate section and the specific gas velocity therein, the cluster can be maintained in this intermediate section for a sufficient period of time until the cluster fully breaks up. In other words, allowing the cluster to transfer up to the riser at the very slow claimed velocity of about 0.9 to 7.2 m/s allows the cluster to be sufficiently broken up, resulting in the uniform dispersion of the particles into the gas. As a result, the change in the quantity of particles which is discharged from the reactor and transferred to the riser and the pressure change in the riser both decrease, and thus the particles are circulated smoothly.

The advantageous effects of the present invention obtained by employing the specifically designed intermediate cylindrical section are specifically shown in the Example at pages 11- 13 of the specification. In this experiment, the intermediate cylindrical section (13) has a completely cylindrical shape (elevation angle 90°) and a diameter of 2.6 cm (Dp). The experimental results show that the average pressure change in the riser was small (ΔP_R = 78.4 Pa (8 mmaq)) and that the observed particles in the riser were uniformly dispersed into the gas and rose through the riser, so that the particles circulated smoothly from the separator (16) to the particle-down-flow circulating line (17) without clogging.

Applicants respectfully traverse the Examiner's conclusion that one skilled in the art would have been motivated to utilize an intermediate section with an elevation angle of at least 85 because the gas velocity would be the same or similar when using either a shorter-pipe intermediate section with an elevation angle of less than 85° or longer pipe intermediate section with an elevation angle of 85° or greater.

In contrast with the claimed superficial gas velocity of about 0.9 to 7.2 m/s, Molstedt teaches a far greater gas velocity at the tapered zone of 25 to 100 ft/s (7.6 to 30.5 m/s). Further, Molstedt achieves the progressive increase in superficial gas velocity by passing liberated

hydrogen through a specially tapered zone to adequately transfer the particles from the reactor to the riser, as described at col. 3, lines 65 to 70. The tapered section of Molstedt is thus formed to facilitate the increase in superficial gas velocity, with the introduction of liberated hydrogen, from about 1.0 ft/s in the dense phase fluid bed to about 75 ft/s at the outlet of the upper cone (Molstedt col. 5, lines 48-51).

In contrast, as described at page 12, last 8-9 lines of the present specification, in the inventive experimental apparatus the particles of the intermediate cylindrical section are transferred to the riser at a velocity of 1.25 m/s. The claimed apparatus thus <u>lowers</u> the gas velocity in the intermediate section by widening the elevation angle without additional gas flow.

The Examiner further asserts that it would be within the skill in the art to change the elevation angle in the intermediate section of Molstedt to result in a small average pressure drop and thus circulate particles in the process smoothly. Applicants respectfully traverse this conclusion.

As explained above, there would have been no motivation based on Molstedt to lower the gas velocity in the intermediate section because Molstedt increases the gas velocity in the intermediate section with additional gas flow to circulate particles in the process smoothly without surging and slugging in the coking zone outlet (col. 3, lines 68-70). It was only with experimental research whereby Applicants determined that lowering the gas velocity in the intermediate section is effective at achieving a small pressure drop. Further, Molstedt does not recognize that the change in the pressure drop is mainly caused by the structure of the intermediate section, and thus, based on Molstedt, there would have been no motivation to change the elevation angle in such a section. For these reasons, the present invention would not have been obvious based on Molstedt and reconsideration and withdrawal of the § 103(a) rejection are respectfully requested.

In view of the preceding Amendment and Remarks, it is respectfully submitted that the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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Enclosure – Petition for Extension of Time (one month)